Original article

Future Human Resources Balance for Pharmacy and Health Consumer Protection Services in Thailand

*Nipa Payanantana *, Sumon Sakolchai **, Kitti Pitaknitinun *, Duangta Palakornkul * Nopdol Thongnopnua****

** Provincial Hospital Division, Ministry of Public Health, Nonthaburi, Thailand.*
*** Faculty of Pharmaceutical Science, Khon Khan University, Khon Khan, Thailand.*
**** Faculty of Pharmaceutical Science, Srinakarinwirot University, Bangkok, Thailand*

Abstract

The study of future human resources requirements for pharmacy and health consumer protection services in Thailand was carried out using Scenario and Sector Prediction for projections of future trends.

The results showed a requirement of 32,761 - 33,968 pharmacists over the next two decades. The increase of 24,951 - 26,158 from 7,810 existing pharmacists, is equivalent to an increase of approximately 1,300 per year, which is more than the average expected annual production of 1,000 per year.

Sectoral requirements were also calculated, i.e., (1) hospital pharmacists at 12,260 - 12,820 (2) community pharmacists at 13,827, (3) Industrial pharmacists at 1,364 - 2,011 (4) marketing pharmacists at 2,762, (5) public health consumer protection services at 1,057 and (6) Educational pharmacists at 1,491.

The number of pharmacy technicians required for hospital pharmacy and consumer protection, can be estimated from the pharmacist: pharmacy technician ratio. The pharmacy operation system in the future is expected to be well equipped with high technological innovations in drug dispensing, production and inventory, thus the ratio should be 1:1, or a requirement of 12,677 - 13,237 pharmacy technicians.

Major policy recommendations from this study are: (1) frequent update of clear situation analyses and requirements for every subsector, (2) frequent modification of more flexible production plans, (3) collaboration among organizations in updating clearer roles and responsibilities of every subsector, (4) planning to increase the production rate of pharmacists and pharmacy technicians should be done after the confirmation of the trend of factors influencing the development of the two main subsectors-hospital and community pharmacy, which are very dynamic.

Key words : Pharmacist, Pharmacy technician, Pharmacy service, Human resource requirements, Health future.

Introduction

The main categories of personnel for pharmacy and health consumer protection services in Thailand are pharmacists and pharmacy technicians.

In 1995, Thailand had 7,810 pharmacists and 2,182 pharmacy technicians (Provincial Hospital Division, MoPH). Their responsibilities can be categorized into 6 subsectors, i.e., Hospital pharmacy, Community pharmacy, Industrial pharmacy, Marketing pharmacy, Educational pharmacy and Health consumer protection.

Possible factors that could affect the future human resource requirements include both **external factors**, which comprise health system reform, revision of Public Health Consumer Protection Laws, roles of consumers, and high technological innovations in routine services; and **internal factors**, comprising the roles of professional organizations, revision of pharmacy curriculum and demand for development of pharmacist roles in every subsector.

Attempts in the past to determine future pharmacy services human resource requirements yielded common findings of increasing pharmacist demand in various subsectors[1-6].

On the contrary, a study covering 20 years (1991-2010) human resource requirements by Suksriwong C. found that[7], that from the year 1991 the overall pharmacist shortage would begin to decline, and the real problem would be the imbalance in the distribution of the existing pharmacists. A study by the subcommittee for studying government pharmacist requirements reported in 1993, that there was a requirement of 4,768 pharmacists or an annual increase of 950 during 1993-1997[2]. The Pharmacy Education Coordination Center revealed the gap between the requirement and supply of pharmacists during 1993-2003 for both government and private sector. The requirement was 5,838 and 7,186 while the supply was 3,503 and 5,211 in 1993 and 2003 respectively[3]. Pitaknitinun K. reported in 1994 a requirement of 12 pharmacists and 16 pharmacy technicians for the 401-bed Srisaket Hospital, by comparing working output with productivity norm[4]. The Subcommittee on Pharmacist Development Project reported in 1994, a requirement of 3,470 pharmacists or an annual increase of 119 for the private sector[5]. Trisadikun P.[6] reported a requirement in the year 2009 of 15,467 pharmacists, or an annual increase of 1,031.

This study aims at forecasting future scenarios of each subsector of the pharmacy services and projection of supply of and requirement for pharmacists and pharmacy technicians in Thailand for the next two decades.

Methods

1. Forecast of Future Scenarios.

Future scenarios for each of the 6 subsectors were forecast by the brainstorming process. 9-10 experienced pharmacists in each of the 6 subsectors were recruited for small group brainstorming sessions to determine the future scenarios of each particular subsector. The results were compiled and scenarios were developed by the technical working group.

2. Estimation of Future Supply and Requirement of Pharmacy Workforce.

Future supply was estimated from the future production plan, predicted graduation rate, and annual loss rate. Requirements were estimated by the combination of population ratio, health demand, and service target method, i.e.,

1) Hospital pharmacy : health demand combined with services target through job analysis and workload prediction.
2) Community pharmacy (drug store) : population ratio and service target methods.
3) Industrial pharmacy : health demand estimated from employment demand through expert opinions.
4) Marketing pharmacy : health demand estimated from business expansion prediction through expert opinions.
5) Public health consumer protection : service target through job analysis and workload prediction.
6) Educational pharmacy : staff-student ratio method.

The reason to contemplate various different techniques was the different demand and supporting environments of each subsector.

Mismatches of future supply and requirements were then determined and recommendations derived and presented.

3. Brainstorming Session

A meeting of the stake holders for reexamination and readjustment of the forecasts and estimation-including recommendations, was carried out before final revision.

Results

1. Scenarios for Pharmacy and Public Health Consumer Protection services in the next 20 years.

Results from brainstorming sessions revealed 4 possible future scenarios:

1.1 The continuous growth scenario - The growth of the services will increase while the infrastructure continues to be the same.

1.2 The declining society scenario - The growth of the services will decrease, as will the social recognition of the profession.

1.3 The disciplined society scenario - The growth of the services will fruitfully increase. There will be clearly specified professional duties and a distinctive working environment. This is the ideal situation.

1.4 The transformed society scenario - The growth of the services will fruitfully increase. The duties of members of society will be completely changed. Professional groups may be expanded or diminished but the significance of the professional will increase.

The disciplined society scenario is predicted to be the most likely scenario that will be used as the baseline scenario. Within this scenario, it appears that the 6 main subsectors could remain unchanged, while each subsector will progress towards using more professional skills, i.e.,

(1) **Hospital pharmacy**

Hospital pharmacists will play more roles in clinical pharmacy in terms of the patient's drug monitoring and education. High technological innovations for future services will reduce manpower size in various services, i.e. drug procurement, production and dispensing. There will be an increasing private sector (drug store) participation in pharmacy services for the outpatients of hospitals. Hospital pharmacists will be more involved in academic pharmacy education. Hospital drug production will be transformed towards more tailor-made and more sophisticated products.

(2) **Community pharmacy**

Consumer Protection Laws reform, together with the Chain drug store system will strongly support the possibility of providing full time pharmacists at all drug stores. Drug stores will be upgraded to community dispensaries providing first line health services, where the responsible area and target population will be well defined. The number of future drug stores will vary with the population size. Professional organizations, such as the Pharmacy Council, will play more of a role in monitoring the practice of the professionals at drug stores, which will lead to more requirement for full time pharmacists.

(3) **Industrial pharmacy**

High technological innovations will shift the pharmacists role towards more research and development activities, resulting in higher requirements for pharmacists. Compulsory Good Manufacturing Practice (GMP), and requirements of industrial pharmacists in accordance with the number of registered drug formulations, will also increase the roles and requirements for industrial pharmacists.

(4) **Marketing pharmacy**

Pharmacists roles will move from order takers to product specialists. Previous expansion of the drug market was about 20% per year[8]. However, due to the recent economic crisis, the forecasted future expansion rate of the drug market will be 6-8% per year from 1998-2003, and 8-10% per year from 2004 onwards.

(5) **Public health consumer protection**

Remarkably, development of roles in public health consumer protection will result in increasing human resources requirements. Growing interest of the public in health promoting products will also increase the consumer protectors workload. Consumer unifications to protect their benefits will improve the consumer protection system. Increasing the consumers knowledge and interest towards the products will improve rational purchasing as well as quality of the products.

(6) **Pharmacy Education**

More pharmaceutical specialties will be added to the existing curriculum. In accordance with the 8th and 9th University Education Development Plan, additional Faculties of Pharmacy will be established in some universities. More emphasis on the quality assurance of pharmacy graduates will require more teachers. Finally the need for more pharmacy technicians will also require more teaching pharmacists.

2. Human Resource Requirements Projections

2.1 Hospital Pharmacy[9, 10] (see Table 1)

2.1.1 Projection of future parameters

Table 1 Projection of future parameters used for the projections

Year	Outpatient visits[9] in 2 weeks	Inpatient (12% OPD)[10]	Average Duration of Staying in the Hospital (Days)[10]
1995	10,210,000	1,225,200	5.00
2000	11,153,000	1,338,360	4.75
2005	12,080,000	1,449,600	4.50
2010	12,980,000	1,557,600	4.25
2015	13,847,000	1,661,640	4.00

2.1.2 Productivity and staff norms

The average working time for one FTE pharmacist is 7 hours per day, 20 working days per month. Thus, the average working time per month is 140 hours[11]. The average time spent for drug counseling by a pharmacist for one patient is 12.75 minutes[4]. Counseling will be done in 6%, 7%, 8%, 9%, and 10% of outpatients for the year 1995, 2000, 2005, 2010, and 2015 respectively[12]. The average time spent for pharmacists in drug dispensing for one outpatient is 0.65 minutes[4] and approximately 60%-80% of outpatients

will contact the pharmacy for the year 1995-2015 respectively. The average time spent for pharmacists for unit dose drug distribution for one inpatient is 1.77 minutes/case/day[4]. The average time spent for pharmacists in intensive drug monitoring and pharmaceutical care is approximately 29 minutes per inpatient per day[2] and 5 % of inpatients will be intensively monitored. Drug administration, drug production, drug quality control and drug information require at least 1 pharmacist for the 200-500 beds and 2-3 pharmacists for the larger hospitals. The number of hospitals used for projections of human resources requirements included 700 -1,000 samples for < 200 bed facilities, 500 - 700 samples for 200 - 500 bed facilities, and 60 -100 samples for > 500 bed facilities.

Ratios of pharmacists to pharmacy technicians are estimated under the changing scenarios towards more professional skills, i.e., 1:2, 1:1.75, 1:1.50, 1:1.25, and 1:1 for the years 1995, 2000, 2005, 2010, and 2015, respectively.

2.1.3 Total requirements

The result of the estimations are shown in Tables 2 and 3. In the year 2015, the requirements for hospital pharmacists and pharmacy technicians would be the same, that is 12,260 - 12,820 for each category.

Table 2 Estimation of pharmacist requirements for hospital pharmacy services at 5-year intervals from 1995-2015 AD.

Pharmacist activities	Required Pharmacists x 1,000 hours/2 weeks				
	1995	2000	2005	2010	2015
1. Outpatient services					
1.1 Screening, Checking and Dispensing	66.37	78.54	91.61	105.46	120.01
1.2 Drug monitoring and Counseling	78.11	107.84	143.75	186.18	235.40
2. Inpatient pharmaceutical services					
2.1 Screening, Checking and Dispensing	180.72	187.54	192.43	195.28	196.07
2.2 Drug Therapy monitoring - General cases	148.05	153.64	157.65	159.98	160.63
Requirements (x1,000 hours) / 2wks.	473.25	527.56	585.44	646.90	712.11
Total requirements (person)	7,324	8,164	9,060	10,011	11,020
3. Drug Administration and Drug Information Services (1-3 pharmacists)			620 - 900		
4. Production / Quality Control (1-3 pharmacists)			620 - 900		
Grand Total Requirement (persons)	8,564 - 9,124	9,404 - 9,964	10,300 - 10,860	11,251 - 11,811	12,260 - 12,820

Table 3 Estimation of pharmacy technician requirements at 5-year intervals from 1995-2015

Year	Appropriate ratio of pharmacist : pharmacy Technician	Pharmacy technician requirements (persons)
1995	1 : 2	17,128 - 18,248
2000	1 : 1.75	16,457 - 17,437
2005	1 : 1.5	15,450 - 16,290
2010	1 : 1.25	14,063 - 14,763
2015	1 : 1	12,260 - 12,820

2.2 Community Pharmacy (drug store)

2.2.1 Assumption for projections for the years 1995-2015

From the past trend, 200 new drugs stores were established each year. Thus in the year 2015, there will be approximately 13,800 drug stores, with the ratio of drug store to population of 1 : 5,000, with at least one full time pharmacist per store (Table 4).

In order to have 13,800 full time community pharmacists in 2015, a substantial increase from the present number of 1,200, there needs to be an increase of 13% per year.

Table 4 Estimation of community pharmacist requirements in the next 20 years, at 5-year intervals from 1995-2015.

Year	No. of drug stores	Number of pharmacists***	Population (million)[16]	Ratio of full time community pharmacist : population	% of drug store with full-time pharmacist
1995	9,836 *	1,200 **	59.4	1 : 49,500	12.20
2000	~ 10,800	2,210	63.4	1 : 28,687	20.46
2005	~ 11,800	4,073	65.8	1 : 16,155	34.52
2010	~ 12,800	7,505	67.2	1 : 8,954	58.63
2015	~ 13,800	13,827***	69.0	1 : 4,990	100.20

* Source : Office of Food and Drug Administration

** Source : 1995 community pharmacist survey (full time pharmacists)

*** Data for 2000-2015 were calculated from increasing rate of 13% per year

Note : The more complicated "Full time equivalence (FTE)" method was not used in this estimation. Consequently, the estimation is regarded as the minimum requirement, because the maximum working time for a pharmacist is only 7-8 hours per day in comparison with the actual operating hours for one drug store, which averages 12 hours per day.

2.3 Industrial Pharmacy

2.3.1 Assumption for projections over the next two decades

Increasing the rate of industrial pharmacists does not vary with the number of drug firms but varies with the development of production, with GMP, and with roles in developing drug formulas and research and development. The Industrial Pharmacist Group indicates that the real increasing rate will be the same as in the past, with trend data analysis revealing that the overall industrial pharmacist requirement will increase by 2-4 % per year [5], and the requirement over the next 20 years will be 1,364 - 2,011 pharmacists (Table 5).

Table 5 Estimation of industrial pharmacist requirements in the next 20 years, at 5-year intervals from 1995-2015

Year	Number of industrial pharmacists requirements
1995	918 *
2000	1,013 - 1,116
2005	1,119 - 1,358
2010	1,235 - 1,653
2015	1,364 – 2,011

* Source : The Industrial Pharmacist Group

2.4 Marketing Pharmacy

2.4.1 Assumption for projections over the next two decades

According to the Pharmaceutical Production Association (PPA) survey, 47% of all marketing staff are pharmacists, and marketing pharmacist requirements in the drug business increase by 3% per year.[5] Table 6 Shows the estimation of marketing pharmacist requirements in the next 20 years (1995-2015), at 5-year intervals.

Table 6 Estimation of marketing pharmacist requirements in the next 20 years, at 5-year intervals from 1995-2015

Year	Number of marketing pharmacists requirements
1995	1,530 *
2000	1,774
2005	2,056
2010	2,383
2015	2,762

* Source : The Marketing Pharmacist Group

2.5 Public Health Consumer Protection

2.5.1 Assumption for projections over the next two decades

Pharmacist requirements for public health consumer protection services at the provincial level was estimated from the magnitude of workload. The requirements for pharmacists will be 5 persons per province.

At the central level, the requirement for pharmacists in the Department of Medical Sciences and the Office of Food and Drug Administration (FDA) will increase at the normal rate of approximately 2% per year.

Within the next 20 years, the requirement for public health consumer protection service pharmacists will be 1,057 persons (Table 7).

Table 7 Estimation of pharmacist requirements for public health consumer protection services in the next 20 years at the 5-year intervals from 1995-2015

Year	Number of Pharmacists requirements			Total
	Provincial Health Office	Department of Med. Sciences	FDA	
1995	255 *	160 **	300 ***	715
2000	375	176	331	882
2005	375	195	365	935
2010	375	215	403	993
2015	375	237	445	1,057

Source : * Provincial Hospital Division
** Medical Sciences Department
*** Office of Food and Drug Administration

At present, the number of the other professionals working in consumer protection at provincial level is approximately 183 persons. Requirements over the next two decades will be 5 persons per province [2], or a total increase of 375 persons from the year 2000.

2.6 Pharmacy Education

2.6.1 Assumptions for projections

(1) For the "Faculty of Pharmacy", the requirement will be 1 instructor (pharmacist) to 4 students[13].

For the newly established universities, the minimum requirement is 50 persons for each faculty.

(2) For the "Sirinthorn Public Health College" of the Ministry of Public Health, the requirement will be 1 pharmacist to 8 students.

(3) For the "Sirinthorn Public Health College" of the Ministry of Public Health, the requirement will be 1 pharmacy technician to 16 students. The average number of students was predicted to be 340 students per year per class for the 2 year study programme.

2.6.2 Results

The requirement for instructors for pharmacy education in the next 20 years will be 1,491 pharmacists, and 42 pharmacy technicians[6, 14] (Table 8).

Table 8 Estimation of pharmacist requirements for Pharmacy Education in the next 20 years, at 5-year intervals from 1995-2015.

	Number of Pharmacists requirements				
	1995	**2000**	**2005**	**2010**	**2015**
University (16)	619	812	1,012	1,212	1,406
Public Health College (6)	28	85	85	85	85
Total requirement of Pharmacists	647	897	1,097	1,297	1,491
Pharmacy Technicians	14	42	42	42	42

2.7 Total human resource requirements for Pharmacy and public health consumer protection services in the next two decades

Tables 9 and 10 show the estimates and the distribution of the requirements for pharmacists and pharmacy technicians. In the year 2015, the requirement will 32,761 - 33,968 pharmacists and 12,677 - 13,237 pharmacy technicians. The highest growth and proportion is in the community services subsector, which account for about 40% - 42% of the requirement, the hospital pharmacy services subsector account for another 37%, while the other 4 subsectors contribute the rest.

Table 9 Total human resource requirements for Pharmacists in Pharmacy and Public Health Consumer Protection services over the next two decades

Subsectors	Number of pharmacists requirements				
	1995	2000	2005	2010	2015
Hospital Pharmacy	8,564 - 9,124	9,404 - 9,964	10,300 - 10,860	11,251 - 11,811	12,260 - 12,820
Community Pharmacy	1,200	2,210	4,073	7,505	13,827
Industrial Pharmacy	918	1,013 - 1,116	1,119 - 1,358	1,235 - 1,653	1,364 - 2,011
Marketing Pharmacy	1,530	1,774	2,056	2,383	2,762
Consumer Protection	715	882	935	993	1,057
Pharmacy Education	647	897	1,097	1,297	1,491
Total requirement	13,574 - 14,134	16,180 - 16,843	19,580 - 20,379	24,664 - 25,642	32,761 - 33,968

Table 10 Total manpower requirement for Pharmacy Technicians in the next two decades

Subsectors	Number of Pharmacy Technicians requirements				
	1995	2000	2005	2010	2015
Hospital Pharmacy	17,128 - 18,248	16,457 - 17,437	15,450 - 16,290	14,063 - 14,763	12,260 - 12,820
Community Pharmacy	-	-	-	-	-
Industrial Pharmacy	-	-	-	-	-
Marketing Pharmacy	-	-	-	-	-
Consumer Protection	183	375	375	375	375
Pharmacy Education	14	42	42	42	42
Total	17,325 - 18,445	16,874 - 17,854	15,867 - 16,707	14,480 - 15,180	12,677 - 13,237

3. Supply projections

3.1 Pharmacists

3.1.1 Production

Table 11 shows the expected enrollment of first year students in the 16 established and projected pharmacy schools according to the higher education development plans[15, 16].

Table 11 Number of pharmacy students expected to enter universities at 5-year intervals

University	Year				
	1995	**2000**	**2005**	**2010**	**2015**
Chulalongkorn	200	220	220	230	240
Chiang Mai	130	130	130	140	140
Mahidol	120	140	140	140	160
Songklanakarin	100	120	120	130	140
Khon Kaen	100	120	120	130	140
Silaprakorn	100	120	120	130	140
Rangsit	60	70	70	80	80
Naresorn	60	80	80	100	120
Hua Cheow Chalerm Prakiat	60	70	70	80	80
Ubonratchathani	40	60	60	80	90
Srinakarinvirotch	-	40	40	60	80
Thammasat (* 2000)	-	-	60	60	80
Mahasarakam (* 2000)	-	-	60	60	80
Kasetsart (* 2010)	-	-	-	-	80
Suranari (* 2010)	-	-	-	-	80
Walailaksana (* 2010)	-	-	-	-	80
Total	970	1,170	1,290	1,420	1,810

* Expected year of establishment of Faculty of Pharmacy, according to higher education development plan.[15, 16]

3.1.2 Existing numbers and projected loss

(1) The actual number of pharmacists in 1995:

- The number of pharmacists registered with the Pharmacy Council was 9,457.
- The numbers of working pharmacists surveyed from many professional branches were 7,810, or 82.5% of registered pharmacists, which can be divided into:
  - Hospital Pharmacists 2,800
  - Community Pharmacists (Drugstore) 1,200
  - Industrial Pharmacists 918
  - Marketing Pharmacists 1,530
  - Public Health Consumer Protection 715
  - Education Pharmacists 647

(2) **The annual loss rate.**

In stable conditions, it can be assumed that the annual loss rate of pharmacists should be around 3% - 4%. This is compatible with the working life of 25 - 33 years, respectively[17]. However, due to the rapid increase in production rates (Table 11), the dynamics of pharmacist production is in an expanding state. So it is estimated that the annual loss rate should be much less. An annual loss rate of 1.0% to 1.5% are used in this study.

3.1.3 Future supply

Table 12 shows the projected supply of future pharmacists. The loss rate of 1.0% - 1.5% will be used. In the year 2015, the projected supply of pharmacists will be 25,846 and 24,401. It should be noted that these number will increase rapidly after 2000 due to increase in production rate (Table 13).

Table 12 Supply projected for pharmacist in the next two decades

Fiscal year	Existing pharmacist at beginning year	Student enrollment	Graduates (96%)	Projected existing pharmacist				Pharmacist : population
				loss rate 1.0%	Number at year end	loss rate 1.5%	number at year end	
1995	7,810 *	720 **	691	78	8,423	117	8,384	1:7,605
1996	8,384-8,423	720	691	84	9,030	126	8,949	
1997	8,949-9,030	720	691	90	9,631	134	9,506	
1998	9,506- 9,631	720	691	96	10,226	143	10,054	
1999	10,054-10,226	720	691	102	10,815	151	10,594	
2000	10,594-10,815	970	931	108	11,638	159	11,366	1:5,923
2001	11,366-11,638	970	931	116	12,453	170	12,127	
2002	12,127-12,453	970	931	125	13,259	182	12,876	
2003	12,876-13,259	970	931	133	14,057	193	13,614	
2004	13,614-14,057	970	931	141	14,847	204	14,341	
2005	14,341-14,847	1,170	1,123	148	15,822	215	15,249	1:4,451
2006	15,249-15,822	1,170	1,123	158	16,787	229	16,143	
2007	16,143-16,787	1,170	1,123	168	17,742	242	17,024	
2008	17,024-17,742	1,170	1,123	177	18,688	255	17,892	
2009	17,892-18,688	1,170	1,123	187	19,624	268	18,747	
2010	18,747-19,624	1,290	1,238	196	20,666	281	19,704	1:3,503
2011	19,704-20,666	1,290	1,238	207	21,697	296	20,646	
2012	20,646-21,697	1,290	1,238	217	22,718	310	21,574	
2013	21,574-22,718	1,290	1,238	227	23,729	324	22,488	
2014	22,488-23,729	1,290	1,238	237	24,730	337	23,389	
2015	23,389-24,730	1,420	1,363	247	25,846	351	24,401	1:2,869

* Source : Provincial Hospital Division, 1995.

** Number of Pharmacy students enrolled 5 years before 1995 the calculation.

3.2 Pharmacy Technician Production Capacity

The average annual enrollment is 340 persons per year, according to the production plan of the MoPH. With around 98% graduation rate, there will be an average increase of 320 new pharmacy technicians per year. The annual loss rate was expected to be higher than for pharmacists because of stable production and less favourable working conditions. The loss rate of 2.5% - 3% will be used. In the year 2015, the number of projected pharmacy technicians will be 6,191.

Table 13 Supply projections for pharmacy technicians over the next two decades

Fiscal year	Number at beginning year	Projected new graduates	Projected existing pharmacy technicians			
			loss rate 2.5%	Number at year end	loss rate 3%	number at year end
1995	2,182 *	320	55	2,447	65	2,437
1996	2,437-2,447	320	61	2,706	73	2,684
1997	2,684-2,706	320	68	2,958	81	2,923
1998	2,923-2,958	320	74	3,204	88	3,155
1999	3,155-3,204	320	80	3,444	95	3,380
2000	3,380-3,444	320	86	3,678	101	3,599
2001	3,599-3,678	320	92	3,906	108	3,811
2002	3,811-3,906	320	98	4,128	114	4,017
2003	4,017-4,128	320	103	4,345	121	4,216
2004	4,216-4,345	320	109	4,556	126	4,410
2005	4,410-4,556	320	114	4,762	132	4,598
2006	4,598-4,762	320	119	4,963	138	4,780
2007	4,780-4,963	320	124	5,159	143	4,957
2008	4,957-5,159	320	129	5,350	149	5,128
2009	5,128-5,350	320	134	5,536	154	5,294
2010	5,294-5,536	320	138	5,718	159	5,455
2011	5,455-5,718	320	143	5,895	164	5,611
2012	5,611-5,895	320	147	6,068	168	5,763
2013	5,763-6,068	320	152	6,236	173	5,910
2014	5,910-6,236	320	156	6,400	177	6,053
2015	6,053-6,400	320	160	6,560	182	6,191

* Source : Provincial Hospital Division , 1995.

4. Matching Requirements and Supply

4.1 Pharmacists

The intensity of pharmacist shortage will decline from the 37.9%-40.4% mismatch in the year 1995, to a 21.1% - 23.9% mismatch in the year 2015, with a projected shortage of pharmacists in the year 2015 at 6,915 - 8,122 persons (Table 14). It should be noted that this mismatch depends much on the assumption of the growth of the hospital and community pharmacy subsectors in this ideal disciplined society scenario.

Table 14 Comparison of pharmacists requirements and supply (1995-2015)

Year	projected requirements	Highest projected supply	mismatch ( ) = shortage	% mismatch
1995	13,574-14,134	8,423	(5,151-5,711)	(37.9-40.4)
2000	16,180-16,843	11,638	(4,542-5,205)	(28.1-30.9)
2005	19,580-20,379	15,822	(3,758-4,557)	(19.2-22.4)
2010	24,666-25,642	20,666	(3,998-4,976)	(16.2-19.4)
2015	32,761-33,968	25,846	(6,915-9,122)	(21.1-23.9)

4.2 Pharmacy Technicians

The shortage of pharmacy technicians in the year 1995 was about 85.9% - 86.7%, and this situation will be maintained until the year 2015 when it will drop to about 48.3% - 50.4%. The main reason is due to the innovations of high technology equipment that decreases the requirements for pharmacy technicians. The shortage of pharmacy technicians in the year 2015 will be 6,117-6,677 persons (Table 15). It should be noted that this mismatch depends much on the assumption of the growth of the hospital pharmacy subsector in this ideal disciplined society scenario.

Table 15 Comparison of pharmacy technicians requirements and supply (1995-2015)

Year	projected requirements	highest projected supply	mismatch ( ) = shortage	% mismatch
1995	17,325 - 18,445	2,447	(14,878 - 15,998)	(85.9 – 86.7)
2000	16,874 - 17,854	3,678	(13,196 - 14,176)	(78.2 – 79.4)
2005	15,867 - 16,707	4,762	(11,105 - 11,945)	(70.0 – 71.5)
2010	14,480 - 15,180	5,718	(8,762 - 9,462)	(60.5 – 62.3)
2015	12,677 - 13,237	6,560	(6,117 - 6,677)	(48.3 – 50.4)

Conclusions and Recommendations

Future scenarios of the six subsectors of pharmacy and consumer protection services were forecast by brainstorming sessions. It was concluded that there may be 4 future scenarios, i.e., continuous growth, declined society, disciplined society, and transformed society scenarios. The disciplined society is the most likely and desirable, and is used as the baseline scenario in this study. In this scenario, there will be an increase in the pharmacy professional services and more community and patient based services, using higher technology. Future supply and requirements for pharmacists and pharmacy technicians between 1995-2015 were estimated through the combination of 3 methods. It was found that the highest supply of pharmacists and pharmacy technicians in the year 2015 would be 25,846 and 6,560; while the requirement would be 32,761 - 33,968, and 12,677 - 13,237, respectively. The comparison between supply and requirements shows mismatches (shortages) of 6,915 - 8,122 pharmacists, and 6,117 - 6,677 pharmacy technicians or 21.1% - 23.9%, and 48.3% - 50.4% of total requirements, respectively. This mismatch depends much on the growth of the hospital and community pharmacy subsectors which are very dynamic. It should be noted that this estimation was based on the ideal disciplined society scenario. Calculations based on other scenarios will yield lower requirements.

It can be concluded that if the ideal disciplined society scenario transpired, the current shortage of pharmacists and pharmacy technicians will continue to be a big problem in the year 2015.

However, in the midst of the current economic crisis, and the era of health care and civil service reform, there may not be as much increase in requirements in public hospitals. At the same time, cultural and socio-economic factors may not allow 100% coverage of pharmacists in every pharmacy. Thus the real situation may result in an adequate supply or oversupply of pharmacists in the next 20 years.

From the study it is recommended that :-

(1) As there are many dynamic external and internal influencing factors contributing to the development of pharmacy and public health consumer protection services, it

is necessary to occasionally (every 3 - 5 years) analyze and forecast the future scenarios for every subsector and the future work force supply and requirements. Such high dynamicity also calls for more flexible production plans which can be easily adjusted to the possible rapid changes.

(2) The various categories of manpower working in different subsectors create a need to define clear roles and responsibilities in each of the subsectors, to avoid repetition or overlapping work.

(3) Pharmacy technician requirements depend upon with many factors including the implementation of high technology instruments or interventions and modification of pharmacist roles. Thus, projections for pharmacy technician requirements should always be carried out at the same time as the projection for pharmacists requirements. Due to its consistent low production with higher loss rate, there are possible requirements to carefully and flexibly increase the production rate of pharmacy technicians.

(4) More definite career paths and incentives should be established for pharmacists and pharmacy technicians to reduce the annual loss rate.

(5) While there is dynamicity and uncertainty in the future supply and requirements, and there is a need to solve the existing mismatches, the projections should be long enough (20 - 25 years), updated quite often (3 - 5 years), and short term action established to solve the existing problems.

References

1. Jaidee S, Kulsomboon V, Thanaviriyakul S et al. **Pharmacist manpower planning in community hospitals**. Bangkok: Social Pharmacy Unit, Faculty of Pharmaceutical Sciences, Chulalongkorn University, 1994.
2. Subcommittee for Studying Government Pharmacist Requirement. **Trend of pharmacist requirement for government sector (1993-1997)**. Bangkok: Provincial Hospital Division, Ministry of Public Health, 1993.
3. Pharmacy Education Coordination Center. **Pharmacy manpower planning in next decade (1993-2003)**. Bangkok: Pharmacy Education Coordination Center, 1992.
4. Pitaknitinun K, Daosodsai P, Jongsirilerd P et al. **Hospital Pharmacy Workload Measurement : a case study in Srisaket General Hospital**. Bangkok: Provincial Hospital Division, 1994.
5. Subcommittee for Pharmacy Development Project. **Pharmacist manpower requirement in private sectors**. Bangkok: Pharmacy Education Coordination Center, 1994.
6. Trisadikun P. **Pharmacist requirement : 15 years production plan (1994-1999).** Bangkok : Pharmacy Education Coordination Center, 1994. (mimeography in Thai)
7. Suksriwong C. **Next 20 years (1991-2010) pharmacist manpower planning**. A thesis for Doctor of Philosophy of Mahidol University. Bangkok: Mahidol University, 1992. (mimeography in Thai)
8. Wibulpolprasert S, KornKasem M, Yarnpasak N. **The Thai Drug System**. Bangkok: The Desire co., 1994.
9. Pannaniramai M., Suksiriserikul S., Projected demand of health service and medical doctors in the next 20 years. *TDRI quarterly*, 1996.
10. Bureau of Health Policy and Plan. **Public health statistics, 1995**. Bangkok: Veteran press, 1996.

11. Civil Service Commission. **Standard working hours of government official personnel**. Bangkok: Office of Prime Minister, 1995.
12. Human Resources planning Division. **Population Projection 1992-2015**. Bangkok: Nation Economic and Social Development Board, 1993.
13. Sakolchai S, Jaiard P, Prakongphan S et al. **Method for pharmacy teacher development**. Bangkok: Subcommittee on Pharmacy Development Project, 1991.
14. Ministry of University Affairs. **The 8th Higher Education Development Plan**. Bangkok: Ministry of University Affair, 1996.
15. Ministry of University Affairs. **The 9th Higher Education Development Plan**. Bangkok: Ministry of University Affair, 1996.
16. Wibulpolprasert S. **Managing human resources for health**. A training module for the World Bank Flagship Training Program on Health Sector Reform. World Bank: Washington DC, 1997. (Mimeography)